Activity 3 – Heuristic Analysis Report

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Matrix Number : 17158735/1

Introduction

AIND-isolation game is a game of two players. Both players will play on same board and the only movement is L shape. The objective of this game is to make the opponent's available movement to become zero. In this project, minimax algorithm with alpha beta pruning is implemented and a heuristic score is made to evaluate the movement.

Algorithm - Minimax with alpha-beta pruning

Minimax is a backtracking algorithm and it has two players playing game with each other. The maximizer will try to maximize the possible score for the player while minimizer will minimize the possible score for the player. Alpha-beta pruning is an optimization technique for minimax algorithm. It reduces the amount of search required to be done by minimax algorithm by cutting of the unnecessary branches in the minimax tree.

Heuristic score

The player will try to maximize the possible movement that overlap with opponent possible movement. It also will try to minimize the opponent possible movement. The formula used is $p - (o * 2) + A$ where p is number of player's possible movement, o is number of opponent possible movement and A is movement that overlap between both player's possible movement.

Result

The result of this heuristic scoring method is good compared to others. It able to reach 72.86% score. The name of this agent is "GROUP1". Table below shows the comparison between all agents.

Agent	Score (%)
GROUP1 (Vincent)	72.86
Kai Wen	86.43
Vern Sin	72.14
Eleysa	69.29
ID_Improved	60.71
Student 1	68.57
Student 2	61.43
Student 3	64.29
Student 4	67.86
Student 5	57.86
Student 6	63.57
Student 7	68.57

Appendix – Console Output for each agent

```
**************************
  Evaluating: GROUP1
**************************

Playing Matches:
----------
  Match 1:   GROUP1    vs   Random      Result: 16 to 4
  Match 2:   GROUP1    vs   MM_Null     Result: 16 to 4
  Match 3:   GROUP1    vs   MM_Open     Result: 16 to 4
  Match 4:   GROUP1    vs MM_Improved   Result: 12 to 8
  Match 5:   GROUP1    vs   AB_Null     Result: 15 to 5
  Match 6:   GROUP1    vs   AB_Open     Result: 11 to 9
  Match 7:   GROUP1    vs AB_Improved tournament.py:101: UserWarning: One or more agents lost a match this round due to
timeout. The get_move() function must return before time_left() reaches 0 ms. You will need to leave some time for the f
unction to return, and may need to increase this margin to avoid timeouts during  tournament play.
  warnings.warn(TIMEOUT_WARNING)
       Result: 16 to 4


Results:
----------
GROUP1              72.86%
```

```
**************************
 Evaluating: ID_Improved
**************************

Playing Matches:
----------
  Match 1: ID_Improved vs   Random      Result: 18 to 2
  Match 2: ID_Improved vs   MM_Null     Result: 13 to 7
  Match 3: ID_Improved vs   MM_Open     Result: 7 to 13
  Match 4: ID_Improved vs MM_Improved   Result: 10 to 10
  Match 5: ID_Improved vs   AB_Null     Result: 14 to 6
  Match 6: ID_Improved vs   AB_Open     Result: 12 to 8
  Match 7: ID_Improved vs AB_Improved   Result: 11 to 9


Results:
----------
ID_Improved         60.71%
```

```
**************************
  Evaluating: Student1
**************************

Playing Matches:
----------
  Match 1:  Student1   vs   Random      Result: 16 to 4
  Match 2:  Student1   vs   MM_Null     Result: 16 to 4
  Match 3:  Student1   vs   MM_Open     Result: 13 to 7
  Match 4:  Student1   vs MM_Improved   Result: 12 to 8
  Match 5:  Student1   vs   AB_Null     Result: 13 to 7
  Match 6:  Student1   vs   AB_Open     Result: 12 to 8
  Match 7:  Student1   vs AB_Improved   Result: 14 to 6


Results:
----------
Student1            68.57%
```

```
**************************
  Evaluating: Student2
**************************

Playing Matches:
----------
  Match 1:  Student2   vs   Random      Result: 17 to 3
  Match 2:  Student2   vs   MM_Null     Result: 10 to 10
  Match 3:  Student2   vs   MM_Open     Result: 12 to 8
  Match 4:  Student2   vs MM_Improved   Result: 13 to 7
  Match 5:  Student2   vs   AB_Null     Result: 13 to 7
  Match 6:  Student2   vs   AB_Open     Result: 12 to 8
  Match 7:  Student2   vs AB_Improved   Result: 9 to 11


Results:
----------
Student2            61.43%
```

```
**************************
  Evaluating: Student3
**************************

Playing Matches:
----------
  Match 1:  Student3   vs   Random      Result: 18 to 2
  Match 2:  Student3   vs   MM_Null     Result: 14 to 6
  Match 3:  Student3   vs   MM_Open     Result: 9 to 11
  Match 4:  Student3   vs MM_Improved   Result: 10 to 10
  Match 5:  Student3   vs   AB_Null     Result: 13 to 7
  Match 6:  Student3   vs   AB_Open     Result: 13 to 7
  Match 7:  Student3   vs AB_Improved   Result: 13 to 7


Results:
----------
Student3            64.29%
```

```
**************************
  Evaluating: Student4
**************************

Playing Matches:
----------
  Match 1:  Student4   vs   Random      Result: 19 to 1
  Match 2:  Student4   vs   MM_Null     Result: 16 to 4
  Match 3:  Student4   vs   MM_Open     Result: 13 to 7
  Match 4:  Student4   vs MM_Improved   Result: 9 to 11
  Match 5:  Student4   vs   AB_Null     Result: 15 to 5
  Match 6:  Student4   vs   AB_Open     Result: 12 to 8
  Match 7:  Student4   vs AB_Improved   Result: 11 to 9


Results:
----------
Student4            67.86%
```

```
**************************
  Evaluating: Student5
**************************

Playing Matches:
----------
  Match 1:  Student5   vs   Random      Result: 16 to 4
  Match 2:  Student5   vs   MM_Null     Result: 13 to 7
  Match 3:  Student5   vs   MM_Open     Result: 11 to 9
  Match 4:  Student5   vs MM_Improved   Result: 8 to 12
  Match 5:  Student5   vs   AB_Null     Result: 12 to 8
  Match 6:  Student5   vs   AB_Open     Result: 10 to 10
  Match 7:  Student5   vs AB_Improved   Result: 11 to 9


Results:
----------
Student5            57.86%
```

```
**************************
  Evaluating: Student6
**************************

Playing Matches:
----------
  Match 1:  Student6   vs   Random      Result: 18 to 2
  Match 2:  Student6   vs   MM_Null     Result: 13 to 7
  Match 3:  Student6   vs   MM_Open     Result: 10 to 10
  Match 4:  Student6   vs MM_Improved   Result: 10 to 10
  Match 5:  Student6   vs   AB_Null     Result: 15 to 5
  Match 6:  Student6   vs   AB_Open     Result: 11 to 9
  Match 7:  Student6   vs AB_Improved   Result: 12 to 8


Results:
----------
Student6            63.57%
```

```
**************************
  Evaluating: Student7
**************************

Playing Matches:
----------
  Match 1:  Student7   vs   Random      Result: 19 to 1
  Match 2:  Student7   vs   MM_Null     Result: 13 to 7
  Match 3:  Student7   vs   MM_Open     Result: 12 to 8
  Match 4:  Student7   vs MM_Improved   Result: 12 to 8
  Match 5:  Student7   vs   AB_Null     Result: 16 to 4
  Match 6:  Student7   vs   AB_Open     Result: 12 to 8
  Match 7:  Student7   vs AB_Improved   Result: 12 to 8


Results:
----------
Student7            68.57%
```